March 17, 2008

AKART evaluation for nutrient removal

Project Objective

The purpose of this project is to conduct an engineering evaluation of advanced treatment for removing nutrients (nitrogen and phosphorus) from wastewater. This evaluation will support the Washington Department of Ecology (Ecology) in defining performance standards representing *all known, available and reasonable treatment (AKART) for removing nutrients from wastewater. The evaluation will utilize currently available information about exemplary wastewater treatment and use commonly applied economic methods for estimating the costs associated with applying treatment to remove nutrients.

Problem statement

Phosphorus loading to fresh water systems and nitrogen loading to marine waters contributes to low dissolved oxygen, diurnal swings in pH, and algae blooms which negatively affect fish and wildlife, aesthetics, recreation and navigation. S*econdary* treatment which is commonly applied by municipal wastewater treatment plants does not remove enough phosphorus or nitrogen from wastewater to prevent degradation of water quality in the receiving waters. These technology-based requirements are out-of-date and do not reflect the advances in treatment technology that have developed in the decades since Ecology and EPA established secondary treatment requirements.

The water quality of other large and important water bodies, such as Chesapeake Bay, Long Island Sound, Gulf of Mexico and the Florida Everglades are impaired by excessive nutrients and reducing these pollutants is recognized as necessary to restore water quality. The necessity of reducing nutrients is also becoming more clearly identified as a priority for protecting Puget Sound water quality. However, at this time only one of the 65 direct discharges of wastewater into the Puget Sound provides treatment to remove nitrogen. This discharger successfully removes over 90% of the nitrogen from municipal influent at a cost that is affordable to utility users. Providing similar treatment for nutrient removal to other discharges into South/Central Puget Sound could eliminate over 30 million pounds of nitrogen loading a year from reaching estuary waters.

Currently, Ecology addresses water quality problems caused by excessive nutrients (Spokane River, Wenatchee River, Moses Lake, and South Puget Sound) by expensive water quality studies and allocation of loading on a case-by-case basis. These water quality evaluations are technically complex and have included a costly and time consuming pollutant loading negotiation process (Total Maximum Daily Load or TMDL). As the State's population increases, nutrient loading increases proportionately, causing additional water quality problems. A number of states, including Michigan, Minnesota and Massachusetts, have defined minimum discharge requirements for phosphorus

on a technology basis in regulation. Defining a discharge requirement for nutrients by regulation may postpone or eliminate the need for the costly TMDL process and generally improve water quality state-wide.

Project proposal and outcomes

Ecology is seeking contractor assistance to conduct the technical and economic evaluation necessary for establishing AKART for removal of nutrients from municipal wastewater discharges in Washington. This evaluation would support development of state agency rule-making for an AKART determination. The scope of the evaluation must include treatment to remove phosphorus from fresh water discharges, nitrogen from marine discharges and phosphorus plus nitrogen for discharges to estuarine waters.

Specific project tasks include:

- Communicate with technical staff and managers (AKART team) assigned to this project as identified in the final work plan.

- Develop cost estimates for installing treatment for nutrient removal expressed as capital and operating costs. The impacts on average residential sewer fees will be presented in the evaluation results (as scenario examples). Cost-to-benefit analyses of nutrient treatment may also be included in the final report to support subsequent state rulemaking efforts.

- Provide other factors such as space required, residual disposal, air emissions, etc. that must be considered for each treatment type.

- Provide a final report which recommends a standard of performance for removing nutrients from municipal wastewater. The standards of performance will be expressed as an effluent concentration and a typical percent removal for phosphorus, nitrogen, and phosphorus plus nitrogen. It is anticipated that an ongoing EPA review of nutrient treatment (see Attachment 1) will provide much of the information necessary to complete this project. EPA is scheduled to publish their final report in February 2008.

- If requested, present information about evaluation results to key stake holder groups, including the Water Quality Partnership, Puget Sound GMAP, and Puget Sound Partnership.

- The estimated time necessary to complete the above tasks is 12 months.

*Ecology is delegated to administer the NPDES program in Washington State and uses both federal and state authority for establishing technology-based

permit requirements. The State's water pollution law and regulation requires application of "*All known, available, and reasonable methods of treatment* under RCW 90.52.040, 90.54.020 (3)(b), and 90.48.520; including effluent limitations established under sections 301, 302, 306, and 307 of the FWPCA." This state technology-based directive has been given the acronym of AKART. An AKART determination may be expressed as a standard of performance such as an effluent concentration, and/or by specifying application of a specific treatment technology as was done for the federal secondary treatment standards. Ecology used this standard to prohibit marine waivers and require all municipalities to treat to secondary standards.

Very briefly explain how/why this proposal:

Establishing AKART and applying treatment to reduce the amount of nutrients discharged into state waters will significantly reduce this pollutant loading. Excessive nutrients currently impair both fresh and marine water quality in many locations and applying AKART-based requirements will achieve improved water quality much faster than the current watershed-by-watershed approach.

The draft State-EPA agreement (PPA) recognizes the need for Ecology to obtain funding to support this work. (From page 24 of the 2007-2009 Public Review Draft of the PPA http://www.ecy.wa.gov/biblio/0701028.html):

> As the population of Washington State continues to increase, nutrient releases of nitrogen and phosphorus to surface waters will become a much larger problem. Advanced technology to treat nitrogen and phosphorus in wastewaters is readily available and may be cost effective for municipal and industrial dischargers. To the extent resources are available, Ecology will work with EPA to do the engineering and economic studies that would be necessary to establish technology-based requirements (All Known Available and Reasonable Treatment, Best Available Treatment) and evaluate the feasibility and necessity of requiring all dischargers to treat and reduce nutrients in wastewater. EPA will provide support to Ecology in evaluating treatment options, expected performance, and costs of applying available technologies for nutrient and associated pollutant removal.

The Puget Sound GMAP reviews called for Ecology to explore this option. The GMAP link is: http://www.accountability.wa.gov/reports/environment/20070320/CYNutrients.pdf.

This project supports the strategic plan goal of Protect and Restore Puget Sound - Preventing conventional pollution to the Sound.

This project supports the Puget Sound initiative by reducing nutrient loading to the Sound, reducing algae blooms and fish kills and improving aesthetics. The agency has established a schedule of GMAP deliverables that depend on the timely completion of this work. This project has been discussed with stakeholders only tangentially at the Water Quality Partnership. If the engineering study is approved for funding, we will expand the discussions with the Water Quality Partnership.

Briefly describe the consequences if this proposal is not funded:
If this proposal is not funded, the WQP will continue to address water quality problems caused by nutrients through the expensive and time consuming TMDL process on a case-by-case basis.

March 17, 2008

Attachment 1 – Table of Contents from an EPA report

USEPA Nutrient Control Technology Assessment - Report Outline
Draft September 12, 2006

Executive Summary

Chapter 1: Introduction
- Background
- Purpose of the Document
- General Discussion of Nutrient Control
- Table of applicable technologies (general information)

Chapter 2: Technologies
- General Discussion of limits and approaches
    - o <u>Phosphorus Only Processes</u>
        - TP Limit of 1 mg/l and higher
            - Types of processes (physical/chemical/biological)
                - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, considerations, constraints, special requirements, etc.)
        - TP Limits of 1 – 0.5 mg/l
            - Types of processes (physical/chemical/biological)
                - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, considerations, constraints, special requirements, etc.)
        - TP Limit of 0.5 – 0.1 mg/l
            - Types of processes (physical/chemical/biological)
                - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, considerations, constraints, special requirements, etc.)
        - TP Limit of 0.1 mg/l and lower
            - Types of processes (physical/chemical/biological)
                - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, considerations, constraints, special requirements, etc.)

    - o <u>Nitrogen Only Processes</u>
        - TN Limit of 10 – 7 mg/l
            - Types of processes (physical/chemical/biological)
                - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, special considerations, constraints, special requirements, etc.)
        - TN Limits of 7 – 5 mg/l

- Types of processes (physical/chemical/biological)
  - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, special considerations, constraints, special requirements, etc.)

- TN Limit of 5 – 3 mg/l
  - Types of processes (physical/chemical/biological)
    - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, special considerations, constraints, special requirements, etc.)

- TN Limit of 3 mg/l and lower
  - Types of processes (physical/chemical/biological)
    - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, special considerations, constraints, special requirements, etc.)

o <u>Low Level Combined Nitrogen and Phosphorous Processes</u>

- Limit of TN 5 - 3 mg/l and TP 1 – 0.5 mg/l
  - Types of processes (physical/chemical/biological)
    - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, considerations, constraints, special requirements, etc.)
- Limits of TN less than 3 mg/l and TP less than 0.5 mg/l
  - Types of processes (physical/chemical/biological)
    - ❖ Identify Specific Technology or Process (description, capability, reliability, cost, considerations, constraints, special requirements, etc.)

Chapter 3: Optimal Upgrades and Retrofits for Existing Plants

- Approaches for selecting feasible options
- Site specific conditions
- Other considerations
- Recommended Technologies

Chapter 4: Capital and O&M Costs

- Capital costs
- O&M costs
- Factors affecting costs (e.g., permit limits, secondary effluent quality, site-specific conditions, monitoring and reporting requirements, etc.)
- Estimating tools

Chapter 5: Case Studies

- Details process description (design, configuration, HRT, SRT, etc.)
- Performance (wastewater characteristics, effluent limits, reliability, etc.)

- Technical data (overall plant design, flow, population, etc.)
- Cost data (capital, O&M, other)

Chapter 6: Regulatory and Implementation Issues

- General Discussion of Permit related issues
    - Permit limits (term, seasonal, refractory nitrogen, etc.)
    - Criteria and Standards (NPDES permits, TMDL, etc.)
    - Monitoring and Reporting (monthly average, annual average, etc.)
- Watershed-Based Approaches
    - Watershed-based permitting
    - Trading
    - Others

Appendices

Technology Matrix
Cost Models (if available)
Contact Information
References